

## WHAT IS CLAIMED IS:

1. A face recognition method for identifying a person by detecting a three-dimensional shape of the person's face and a surface image thereof and collating the three-dimensional shape of the face and the surface image with enquiry face image data, comprising the steps of:

5       estimating shooting conditions of the enquiry face image data;

          generating referential face image data by the shooting conditions and the three-dimensional shape and an image of the surface thereof using a graphics means;

10       comparing the referential face image data to the enquiry face image data; and

          identifying the person of the enquiry face image data with the person of the referential face image data when a difference between both the face image data is small.

2. A face recognition method having database which stores three-dimensional shapes of human faces and surface images thereof for identifying a person by collating the three-dimensional shape of the specific person's face and the surface image stored in the database with enquiry face image data, comprising the steps of:

5       estimating shooting conditions of the enquiry face image data;

          generating referential face image data by the shooting conditions and the three-dimensional shape and the surface image stored in the database using a graphics means;

10       comparing the referential face image data to the enquiry face image data; and

          identifying the person of the enquiry face image data with the person of the referential face image data when a difference between both the face image data is small.

3. The face recognition method as claimed in claim 1, wherein the shooting conditions include an angle of the face image and lighting directions, and the three-dimensional shape is specified by shape data and color image data.

4. The face recognition method as claimed in claim 2, wherein the shooting conditions include an angle of the face image and lighting directions, and the three-dimensional shape is specified by shape data and color image data.

5. A face recognition method as claimed in claim 1, wherein the referential face image and the enquiry face image are compared after locations of characteristic points, size and brightness of both the face image data have been normalized.

6. A face recognition method as claimed in claim 2, wherein the referential face image and the enquiry face image are compared after locations of characteristic points, size and brightness of both the face image data have been normalized.

7. A face recognition method as claimed in claim 3, wherein the referential face image and the enquiry face image are compared after locations of characteristic points, size and brightness of both the face image data have been normalized as parameters.

8. A face recognition method as claimed in claim 4, wherein the referential face image and the enquiry face image are compared after locations of characteristic points, size and brightness of both the face image data have been normalized as parameters.

9. An object recognition method for identifying an object by detecting a three-dimensional shape of the object and a surface image thereof and collating the three-dimensional shape of the object and the surface image with enquiry image data, comprising the steps of:

- 5       estimating shooting conditions of the enquiry image data;
- generating referential image data by the shooting conditions and the three-dimensional shape and the surface image using a graphics means;
- comparing the referential image data to the enquiry image
- 10   data; and
- identifying the object of the enquiry image data with the object of the referential image data when a difference between both the image data is small.

10. An object recognition method having database which stores three-dimensional shapes of a large number of objects and surface images thereof for identifying an object by collating the three-dimensional shape of the specific object and the surface image

5   stored in the database with enquiry image data, comprising the steps of:

- estimating shooting conditions of the enquiry image data;
- generating referential image data by the shooting conditions and the three-dimensional shape and the surface image stored in the database using a graphics means;
- 10   comparing the referential image data to the enquiry image data; and
- identifying the object of the enquiry image data with the object of the referential image data when a difference between both the image data is small.

11. A face recognition device for identifying a person by

detecting a three-dimensional shape of the person's face and a surface image thereof and collating the three-dimensional shape of the face and the surface image with enquiry face image data, comprising:

5           an image input means for obtaining the enquiry face image by specifying shooting conditions of the enquiry face image data;

          a graphics means for generating referential face image data by the shooting conditions and the three-dimensional shape and the surface image; and

10          an image collating means for comparing the referential face image data with the enquiry face image data to evaluate the images; and identifying the person of the enquiry face image data with the person of the referential face image data when a difference between both the face image data is small.

12. A face recognition device having database which stores three-dimensional shapes of a large number of human faces and surface images thereof for identifying a person by collating the three-dimensional shape of the specific person's face and the surface image stored in the database with enquiry face image data, comprising:

5           a condition input means for specifying shooting conditions of the enquiry face image data to input, the database for storing the three-dimensional shape data of faces and the surface image data;

10          a graphics means for generating referential face image data by the shooting conditions and the three-dimensional shape data and its surface image data stored in the database;

          an image input means for obtaining the enquiry face image data; and

15          an image collating means for comparing and collating the referential face image data with the enquiry face image data, and identifying the person of the enquiry face image data with the person of

the referential face image data when a difference between both the face image data is small.

13. A face recognition device as claimed in claim 11, wherein the surface image is a color image.

14. A face recognition device as claimed in claim 12, wherein the surface image is a color image.

15. The face recognition device as claimed in claim 11, wherein the shooting conditions inputted to the condition input means are an angle of the face image and lighting directions, the image collating means includes a normalizing means for normalizing the referential face image data and the enquiry face image data respectively using a standard face image as the basis, and an image comparing means for comparing outputs of the normalizing means: a normalized enquiry image and a normalized referential color image.

16. The face recognition device as claimed in claim 12, wherein the shooting conditions inputted to the condition input means are an angle of the face image and lighting directions, the image collating means includes a normalizing means for normalizing the referential face image data and the enquiry face image data respectively using a standard face image as the basis, and an image comparing means for comparing outputs of the normalizing means: a normalized enquiry image and a normalized referential color image.

17. The face recognition device as claimed in claim 13, wherein the shooting conditions inputted to the condition input means are an angle of the face image and lighting directions, the image collating

means includes a normalizing means for normalizing the referential face  
 5 image data and the enquiry face image data respectively using a  
 standard face image as the basis, and an image comparing means for  
 comparing outputs of the normalizing means: a normalized enquiry  
 image and a normalized referential color image.

18. The face recognition device as claimed in claim 14,  
 wherein the shooting conditions inputted to the condition input means  
 are an angle of the face image and lighting directions, the image collating  
 means includes a normalizing means for normalizing the referential face  
 5 image data and the enquiry face image data respectively using a  
 standard face image as the basis, and an image comparing means for  
 comparing outputs of the normalizing means: a normalized enquiry  
 image and a normalized referential color image.

19. An object recognition device having database which  
 stores three-dimensional shapes of a large number of objects and surface  
 images thereof for identifying an object by collating contents of the  
 database with enquiry image data, comprising:

5 a condition input means for specifying shooting conditions of  
 the enquiry image data to input, the database for storing the  
 three-dimensional shape data of objects and the surface image data;

a graphics means for generating referential image data by the  
 shooting conditions and the three-dimensional shape data and its surface  
 10 image data stored in the database;

an image input means for obtaining the enquiry image data;  
 and

a image collating means for comparing and collating the  
 referential image data with the enquiry image data, and identifying the  
 15 object of the enquiry face image data with the object of the referential

face image data when a difference between both the image data is small.

20. The face recognition device as claimed in claim 19, wherein the shooting conditions inputted to the condition input means are an angle of the object and lighting directions, the image collating means includes a normalizing means for normalizing the referential image data and the enquiry image data respectively using a standard object image as the basis, and an image comparing means for comparing outputs of the normalizing means: a normalized enquiry image and a normalized referential image.

21. A recording medium storing a program being readable by a computer to operate recognition method having database which stores three-dimensional shapes of a large number of human faces and surface images thereof for identifying a person by collating contents of the database with enquiry face image data, wherein the program comprises the steps of:

estimating shooting conditions of the enquiry face image data;  
generating referential face image data by the shooting conditions and the three-dimensional shape and the surface image stored in the database using a graphics means;

comparing the referential face image data to the enquiry face image data; and

identifying the person of the enquiry face image data with the person of the referential face image data when a difference between both the face image data is small.

22. The recording medium as claimed in claim 21, storing a program being readable by a computer, wherein the shooting conditions include an angle of the face image and lighting directions, and the

three-dimensional shape is specified by shape data and color image data.

23. A recording medium storing a program being readable by a computer to operate recognition method having database which stores three-dimensional shapes of a large number of objects and surface images thereof for identifying an object by collating contents of the database with enquiry image data, wherein the program comprises the steps of:

specifying shooting conditions of the enquiry image data to input;

generating referential image data by the three-dimensional shape and the surface image stored in the database using a graphics means;

obtaining the enquiry image data by an image input means;

comparing and collating the referential image data with the enquiry image data; and

identifying the object of the enquiry image data with the object of the referential image data when a difference between both the image data is small.

24. The recording medium as claimed in claim 23, storing a program being readable by a computer, wherein the shooting conditions include an angle of the object image and lighting directions, and the three-dimensional shape is specified by shape data and color image data.

25. A recording medium storing a program being readable by a computer to operate a recognition method for identifying an object by detecting a three-dimensional shape of the object and a surface image thereof and collating the three-dimensional shape of the object and the surface image with enquiry image data, wherein the program comprises



the steps of:

estimating shooting conditions of the enquiry image data;

generating referential image data by the shooting conditions  
and the three-dimensional shape and its surface image using a graphics  
10 means;

comparing and collating the referential image data with the  
enquiry image data; and

identifying the object of the enquiry image data with the object  
of the referential image data when a difference between both the image  
15 data is small.